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SCIENCE AND TECHNOLOGY

No. 167

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CHINA REPORT

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CONTENTS

ABSTRACTS

NATIONAL DEVELOPMENTS

OLD METHODS, NO COORDINATION SLOW DEVELOPMENT OF INORGANIC CHEMISTRY

Beijing ZIRAN BIANZHENGFA TONGXUN [JOURNAL OF DIALECTICS OF NATURE] in Chinese Vol 4, No 2, 10 Apr 82 pp 31-36

[Article by Ye Bolin [5509 2672 2651] of the National Bureau of Standards: "Some Views on the Development of Inorganic Chemistry in Our Nation*"]

[Text] Many chemists in our nation believe that our nation's inorganic chemistry is a weak branch of chemical science. This situation hinders the effective utilization of our nation's abundant inorganic mineral resources, and it is a contrast to prosperous international development.

Inorganic chemistry is a classical branch of the chemical sciences. It is a science that studies the properties and the utilization of all elements in the periodic table. The discovery of the Mendeleyev periodic table enabled people to acquire a systematic and regular understanding of the elements and it promoted the development of inorganic chemistry. Since the beginning of this century, the rapid development in medicine, the dyeing industry and the petrochemical industry, in-depth studies of life phenomena, especially large biological molecules such as proteins and nucleic acids, the ever changing development of carbon-based organic chemistry (including its branch of high molecular chemistry) have attracted a large group of successful chemists. Although the atomic energy industry and the semiconductor industry have stimulated corresponding development in inorganic chemistry, but, compared to organic chemistry, its progress has been slow. Since the 1940s, traditional inorganic chemistry has changed completely as a result of the discovery and application of various types of inorganic functional materials and mutual infiltration of mathematics, physics, biology and other branches of chemistry. Some chemists at home and abroad believe that a renaissance in inorganic chemistry has arrived!

Before liberation, among the older generation of chemists of our nation, there were more people engaged in organic chemistry and physical chemistry

*This is an investigative research report. Valuable opinions and information have been provided by more than 10 scientists of the Chinese Academy of Sciences and higher educational institutions, the Chemistry Department of the Chinese Academy of Sciences and the Chinese Chemical Society.

but few engaged in inorganic chemistry. After liberation, inorganic chemistry began to develop. The 12-year science and technology development plan drawn up in 1956 established five directions for development: 1) rare elements chemistry; 2) complex chemistry; 3) inorganic synthesis; 4) physicochemical analysis; and 5) isotope chemistry. Later, the Chinese Academy of Sciences, higher educational institutions and some industrial departments established a number of research institutes (laboratories), and inorganic chemistry contributed to the detonation of our nation's two bombs. Because of the urgency of the task at the time, there was more applied research, and science itself did not realize great development. The 10-year plan drawn up in 1963 assigned separate tasks to study complex chemistry, important rare elements, nuclear fuel and our nation's unique and abundant elements. As forces were being organized and as research was being carried out systematically and profoundly, the 10 years of continuous upheaval forced a lot of work to cease. In 1977, at the National Planning Conference for the Disciplines of Natural Sciences, rare earth chemistry was included as a key point in the development of chemistry, but overall plans were not drawn up for other aspects of inorganic chemistry.

Several Existing Problems at the Present Time

1. There is a lack of unified arrangement and rational distribution. According to statistics, throughout the nation, there are over 30 higher educational institutions and 8 scientific research units that possess scientific research and teaching capabilities in inorganic chemistry. Among them, about one third are engaged in the research of rare earth elements. Very little research is being carried out in our nation's other abundant elements, tungsten, molybdenum, vanadium, titanium, antimony, lithium and boron. Research in rare earth elements mainly involves research in the chemistry of solutions, and there is very little research in the chemistry of rare earth solids which is closely related to new materials. The 15th International Rare Earth Elements Conference was held at the University of Missouri in the United States on 15 and 16 June 1981. Since the 8th and 9th conferences, over 80 percent of the papers have been on research in the chemistry of rare earth solids. Research in rare earth chemistry in our nation has not been consistent with the trends in international development. Throughout the nation, there are more than 20 units conducting research in the chemistry of rare earth solutions, 30 to 40 units conducting research in permanent magnetic rare earth materials crowded on one battlefront, each fighting its own battle, each overlapping the other, and each developing blindly.

2. The subjects are out-dated and there are many gaps in the field. Some comrades believe research in inorganic chemistry in our nation is too confined by tradition. Some new concepts, new fields and new methods are not given enough emphasis. Internationally, some new branches of science and active fields in inorganic chemistry such as organo-metallic chemistry, bio-inorganic chemistry, chemistry of inorganic solids, inorganic structural chemistry, compounds of different metals, and non-integer ratio compounds are mostly weak or blank areas in our nation.

3. The strength is lacking and the means are backward. Throughout the nation, the strength in inorganic chemistry is far weaker than that in organic chemistry. The research strength in inorganic chemistry of the Beijing Chemical Institute was transferred entirely to study environmental chemistry. The actinium series and lanthanum series research laboratories of the Changchun Applied Chemistry Institute were completely shut down during the 10 years of upheaval. The lanthanum series elements research laboratory was reestablished as late as 1974. Several higher educational institutions once carried out research in salt lake chemistry but later they all changed. At present, there still is no special inorganic chemistry research institute in the nation. Backward means are also an outstanding problem. A lot of research is still being done with out-dated methods of the 1940s and 1950s such as spectrophotometry and thermal spectroscopy.

4. Systems are scattered, each engages in its own efforts, and there is very little mutual cooperation. Some productive departments have grasped the development and utilization of national resources but have not paid attention to basic research. The Chinese Academy of Sciences and higher educational institutions are relatively strong in basic research but this has not been emphasized and frequently they have no opportunities to make contributions.

Several Views On the Development of Inorganic Chemistry in Our Nation

I. The Emphasis of Research in Inorganic Chemistry Should Be on Combining Efforts With the Development and Utilization of Our Nation's Abundant Elements

Our nation is expansive. The known resources of inorganic minerals are very rich. The deposits of some rare and precious metals are rarely found elsewhere in the world. But, because most of our nation's abundant elements are metallic paragenetic ores, and with the long period of "singular efforts," we have neglected comprehensive utilization of the resources, and many precious elements have been lost in tailings, furnace cinder and smoke and ash. The retrieval rate is very low, and some people say now we are "throwing away the bean curd and eating the dregs of bean curd." Take rare earth elements as an example, the retrieval rate is generally 2 to 3 percent. Some people have estimated that in 1977, the retrieval rate of rare earth elements in our nation was only 1.2 percent, thus, the loss of rare earth elements each year is greater than the annual output in the United States by one magnitude. The retrieval rate of nickel, cobalt and copper is also not high. Of course, in recent years, under direct inquiry by the leading comrades of the Central Committee, and with the big help from concerned departments, the retrieval rate has increased by a relatively large scale.

The extraction of useful elements from natural elements, whether it is the extraction of elements from mineral ore in the melted state (called annealing), or the extraction of elements from solutions in the ionic state (called the wet method), or the extraction of elements by separation from mineral ore using the method of electro-deposition and the method of forming metallic gasified substances, in fact, all rely on the technological processes of certain chemical reactions. Technology is developmental research. Under ordinary conditions, there must be basic research to give it a scientific basis.

Chemistry has a bright future in developmental research in our nation's abundant elements. Inorganic chemistry should take this as the key point.

First, analysis of the change in the valence state of chemical components in mineral resources, selected ore and smelting and refining processes is the basis for comprehensive retrieval of resources. After liberation, our nation's chemical workers conducted a lot of analytical research in rare earth resources and contributed to the development of rare earth chemistry and industry. But, there are still some important mineral resources which are being developed, such as the Panzhihua Mines that contain some beneficial elements which have as yet not been reliably analyzed fully. The run and the distribution of these elements in the present processes of ore selection and smelting are still unclear. We should be able to retrieve cobalt, nickel, copper, selenium and platinum family elements from sulfide ores. At present, besides obtaining a little bit of certain elements, most are lost. The run of the platinum family elements is not completely known. The content of the rare and precious metal scandium is worth exploiting, but the best plan of comprehensive retrieval for existing production flow processes can only be proposed after the run and distribution of scandium in the processes of ore selection and smelting are known and where is scandium highly concentrated is known. Our nation's deposits of tungsten mines are world famous. The methods used to analyze tungsten ore up to now are still those used by Britain and Russia. Tungsten ore contains molybdenum and radioactive elements. The content of molybdenum in exported tungsten ore is strictly controlled. Studying good methods to analyze, concentrate and separate molybdenum and radioactive elements in tungsten ore is the unavoidable responsibility of chemical workers.

Second, the application of extraction chemistry has promoted the development of metallurgy by the wet method. At present, metallurgy by the wet method has become an important developmental trend in smelting technology. This is because foreign nations control atmospheric pollution very strictly. There is less atmospheric pollution using the wet method for smelting. Smelting by the wet method consumes less energy. The extraction of certain elements must be smelted by the wet method, or a combined production flow process of the wet method and annealing must be used to separate and extract them. The extraction of some low grade rare and precious metals must be done by the wet method because smelting by the wet method facilitates comprehensive retrieval of resources. Many of our nation's abundant elements have a complex constituency, paragenesis is compact, and the use of the wet method in smelting seems to have become more and more important. Extraction of elements in solution is the main way of separating the elements in smelting by the wet method. Recently, an international extraction conference was held in September 1980, in Belgium. The main topic of discussion was the problem of extraction in smelting by the wet method. Chemists are experts in studying the chemistry of extraction of elements in solution. The Shanghai Organic Chemistry Institute, the Changchun Applied Chemistry Institute, the Chemical Engineering and Metallurgy Institute of the Chinese Academy of Sciences and Beijing University have synthesized various types of extracting agents, studied the relationship between the structure and the properties of the extracting agents, studied the serial extraction theory which is a plan to

optimize extraction and its application in the separation and extraction of our nation's abundant elements, and they have all realized great achievements. The techniques of extracting and separating thorium and mixed rare earth elements, the techniques of extracting yttrium oxide from mixed rare earth, and studies of lithium isotopes of our nation's abundant elements are all advanced. Some have already been popularized in production and they have reached internationally advanced levels. But, the prices of extracting agents in our nation are high and this has affected the development of metallurgy by the wet method.

The application of extraction chemistry in metallurgy by the wet method has mainly been in the large number of scientific experiments to separate and extract rare earth elements in our nation. The study of other abundant elements and their popularization in production have just begun. Some chemists suggest that if the technique of optimization of serial extraction is used in the enlarged experiments to separate cobalt and nickel at our nation's Jinchuan Mines, it is possible to greatly simplify the proposed technological processes. Now, in the production flow process, if we combine the extraction method with the electro-deposition method, it is estimated that we can retrieve an additional 20,000 tons of copper a year. The study of the annealing method in smelting at the Panzhihua Mines has realized great progress, and smelting by the wet method has a bright future. The first level extraction rate of vanadium by the extraction method to extract vanadium and separate vanadium and chromium as used by the Chemical Engineering and Metallurgy Institute of the Chinese Academy of Sciences has reached over 97 percent, and the extraction rate of chromium has reached 99 percent. This method has a high efficiency in separating vanadium and chromium, it has only a few steps of extraction and back extraction and the circuit is short.

Third, research in physical chemistry of the smelting process is the basis for scientific smelting. Many of our nation's abundant elements are transition elements. An important characteristic of transition elements is that they easily form varied valences. In smelting, what is the valence state of these elements and in what types of compounds do they exist must be known, and we can only grasp the laws of their variation before we can carry out scientific smelting. For example, when Panzhihua Mines used annealing in smelting, formation of low valent titanium compounds could be suppressed only by increasing the degree of oxidation. And, the avoidance of difficulties in separating slag iron and the prevention of furnace slag from becoming viscous and from bodying due to the formation of low valent titanium compounds are possible only by increasing the degree of oxidation. Smelting by the wet method involves many problems in the physical chemistry of solutions. Some chemists believe that at present, experiments in the smelting process seldom study the mechanism of chemical reactions, the variation of the valence stage of elements, the run and distribution of the elements, thermodynamics of chemical reactions, dynamics, etc., therefore, the scientific basis is frequently insufficient, and there is a definite degree of blindness in the experiments and in production.

Fourth, the creation of some new technologies, new techniques, new methods in the smelting process must rely on breakthroughs in chemical methods. The

basis of the smelting process is a chemical problem. Breakthroughs in chemical methods can renovate traditional smelting techniques. For example, the use of fluidization techniques to reduce metals can change certain traditional techniques that use coke for high temperature reduction. The use of the new technique of plasma oxidation to manufacture high grade titanium dioxide requires simple facilities. Annealing lead easily causes lead poisoning and this is very harmful to the human body. Studies in the chemistry of water solutions of lead and the use of the wet method to replace annealing will benefit the health of workers. Besides smelting by the wet method, the technique of smelting by gasification has also developed very rapidly in recent years. It causes some metals to form halides, carboxides and alkyls in ores and these are evaporated and separated from the ores and then processed. Thus, how to combine the characteristics of our resources of abundant elements with chemical methods to provide new technologies, new methods and new techniques of smelting requires in-depth research by chemical workers.

Fifth, basic theoretical research in chemistry will open up a broad future of application of our nation's abundant elements. Some of the resources of our nation's abundant elements are exported only as raw materials or primary products at present and imported as products or semi-finished products. Our nation exports tungsten ore in large quantities at US$11,000 per ton and import large quantities of tungsten filament at US$10 million per ton. Even low grade tungsten ore is controlled by the localities and exported at very low prices. The problem of smelting tungsten has been discussed for several decades but it has not been solved for a long time.

Up to now, our nation still exports mainly fine ores of rare earth. If we can export large quantities of only one kind of rare earth oxide or one kind of permanent magnetic rare earth material or luminous rare earth material, then the price of rare earth will be increased by a thousand or a hundred times. Our nation has less nickel resources. Some people believe plated tungsten carbide is also feasible. Our nation has rich antimony resources. Besides using it to make alloys and in medicine, it is not used in many other ways. How to fully utilize our nation's resources of abundant elements, develop superiority, develop the strong points and avoid the shortcomings to accumulate more capital for national construction are questions that have a lot of potential for development. One of the reasons that has created the above situation is that our basic research is too poor. Some people believe that in applied research in rare earth elements, besides the study of catalytic synthesis of rubber using rare earth elements which can be considered a unique invention of our nation and which has been praised by international colleagues, most of the remaining research efforts imitate foreign nations and we are drawing the gourd following other people's drawings. Up to now, the rare earth elements used in our nation are all based on those used by foreign nations. Although basic physical and chemical data can be used interchangeably, the problem is that we are doing too little in this aspect, and the contribution is too small. In the application of rare earth elements over the past 10 to 20 years, a breakthrough is almost made every 2 to 3 years internationally, and some new uses are being discovered. The United States immediately began basic research in rare earth compounds after completing the work of separating single rare earth elements, and it discovered rare earth

microwave devices, rare earth red fluorescent powder for color television, luminous rare earth materials, permanent magnetic rare earth materials, and rare earth hydrogen storing materials. Some nations do not have a lot of rare earth resources, but the amount of rare earth elements being used exceeds the amount we use, and much more basic research is being done. Our nation's resources are rich, rare earth elements also possess unique physical and chemical properties. Scientists generally believe this is a treasure box of new materials that has a great potential and that is awaiting exploration. Our nation should erect our own flag of basic and creative research in rare earth elements and walk among the leaders of the world. Through the developmental research of our nation's abundant elements, we can push forward the development of some branches of chemistry in a big way. For example, we can develop rare earth chemistry, salt lake chemistry, complex chemistry of transition elements, extraction chemistry, chemical reaction engineering, and closely combine these efforts to solve urgent national tasks and to develop academic disciplines. The United States established and developed high temperature chemistry, chemical reaction thermodynamics and dynamics of many elements while solving problems in the development of its atomic energy industry. This method is worth learning.

II. We Should Pay Close Attention to, Strengthen and Develop the Study of New Branches of Science in Inorganic Chemistry

In 1976, the American Chemical Society held a conference to celebrate its 100th anniversary since its founding. The commemorative publication of the conference mentioned in its article "The Future Outlook of Inorganic Chemistry," "What will the next 100 years bring about in inorganic chemistry?" "Will chemists still have to continue their efforts in inorganic chemistry, or will they be pursuing a certain branch of science that has already been opened up today, or will they pursue still another new science that has yet to be created at present?" "Will inorganic chemistry undergo a reorganization in the next century in such a way that it will again be divided into several small and more clearly marked categories?" Although these statements do not have a clear conclusion, the meaning is very clear. They mean, inorganic chemistry of the future will have to differentiate or regroup, and many new branch sciences will emerge. This is not unfounded prognostication, it is an important developmental trend of the past 30 years in inorganic chemistry.

First, inorganic chemistry and other branches of chemistry are infiltrating each other more and more.

The most obvious is that because of the development of complex compounds, chelates, organo-metallic compounds, the gap between "inorganic" and "organic" has been gradually filled. Some nations have already broken the boundary between "organic" and "inorganic" in their categorization of the branches of chemistry. Some foreign chemists believe that "chemistry of the 21st century will be a mixture of organic and inorganic chemistry." At present, an internationally active field of research is the study of organometallic chemistry.

Before the 1950s, organo-metallic compounds were limited to the main group elements. It was generally believed that transition elements could not form stable organo-metallic compounds. In 1952, the synthesis of ferrocene sandwich activated the broad study of organic compounds of transition elements. Ernst Otto Fischer of West Germany and Geoffrey Wilkinson of Britain who synthesized ferrocene received the 1972 Nobel prize in chemistry. Later, the synthesis of compounds of sandwiched structure developed from 5 rings to 6 and 7 rings and even formed multiple layer cores, cage-like cores, etc. In addition, organo-metallic compounds of special structures such as crowns and envelopes were also discovered. The discovery and synthesis of large amounts of such types of compounds have presented new concepts and new models in the study of the theory of chemical bonds, and at the same time, many practical applications were discovered. Such compounds have a very bright future and they have become an internationally active research field. From 1963 to 1979, seven renowned chemists throughout the world received the Nobel prize in chemistry for their research in organo-metallic chemistry. But, the study of organo-metallic chemistry, compared to other branches of chemistry, is still basically a blank in our nation.

Here we must mention the question of inorganic synthesis. The study of organic synthesis and organic chemical reactions already has a history of 200 years. Fine organic synthesis and organic structural theory are already a relatively mature science. Inorganic synthesis has not yet reached such a degree of perfection. At present, hybrid inorganic and organic development will bring about some new problems in the techniques of synthesis. The synthesis of inorganic spacially structured compounds has already attracted more and more attention. Our nation's work in inorganic synthesis has not yet received widespread attention. After proposing the "Fuzhou model" of the active center of nitrogen fixing in 1977, it was not until 1979 that active substances were preliminarily synthesized according to the hypothesis of the model. At present, the study of the structure and synthesis of inorganic compounds under extreme conditions are a new field in inorganic synthesis. Chemical reactions which do not easily occur under ordinary conditions can be realized under ultrahigh temperatures, ultralow temperatures, in strong magnetic fields, under strong laser irradiation and in plasmas. This has opened up a new field in the synthesis of inorganic compounds.

Second, the mutual infiltration of inorganic chemistry and biology has produced a new branch of science called bio-inorganic chemistry.

The traditional viewpoint believed that functions in a living organism are mainly the result of organic action. This is not completely so. The living organism has more than 70 elements. Most enzymes contain metallic ions and these metallic ions exist in a complex state by combining with organic matter. Metallic ions also frequently function as active centers. During the past 10 to 20 years, people have acquired an understanding of the function of metallic ions in living organisms which chemists were unable to acquire over the past several decades of research. Now, living organisms are important sources of new knowledge and new concepts not only for biologists and organic chemists but also inorganic chemists. In 1972, the publication of

the magazine "Bio-inorganic Chemistry" marked the official birth of this new science. Bio-inorganic chemistry mainly studies the function of various elements in the system of living organisms and it studies the effects of the imbalance of trace elements upon living organisms and interference of the function of one trace element by another trace element, i.e., what is commonly called antagonism in living organisms. The imbalance of some trace elements will cause certain diseases. This has important significance in medical and biological research. Bio-inorganic chemistry also studies the mutual action between metallic ions and protein, nucleic acids, etc. People have discovered that certain metallic complexes, such as platinum complexes, possess a function of hindering cell division, and they are active in resisting the growth of tumors. Nanjing University studied quadrivalent platinum complexes and preliminarily determined that the anti-cancer mechanism is due to the action of the complex on the bonding of the alkaline radical of DNA, thus hindering DNA duplication in the cancer cell. The early evolution of living organisms occurred in the ocean. The ocean contains a rich source of elements for biological evolution. The human body is composed of about 30 elements. This is the result of gradual evolution and selection of the relatively rich source of elements in the ocean. The study of bio-inorganic chemistry will help our understanding of the origin of life. Some research in bio-inorganic chemistry has begun at some of our nation's higher educational institutions and the Chinese Academy of Sciences, but these are all scattered efforts. Systematic development of research in bio-inorganic chemistry is still in a "reading stage" of writing papers. This new field urgently needs to be deployed to catch up.

Third, physics has given strong support to the development of inorganic chemistry in theory and experimental technology on the three levels of atomic and nuclear physics, atomic and molecular physics and coacervation state physics. This is one important factor in the prosperous development of inorganic chemistry during the past several decades. The trend of development in modern chemistry is to advance from the macroscosmic to the microscopic, from state to dynamic, from the qualitative to the quantitative, from the body phase to the surface. All of these cannot be separated from the infiltration of physics. Even like such a simple crystal as sodium chloride, its microscopic structure can only be learned after it is exposed to X-rays. In 1956, two American chemists used the methods of quantum chemistry to propose the famous "symmetric conservation law of molecular orbits," and the structure of some metallic complexes were ingeniously matched in calculations and in experimental results. Research in laser chemistry discovered that the molecules of some compounds such as those of rare earth compounds possessed a multiple photon absorption effect in a strong infrared field. These molecules can dissociate without colliding in the strong infrared field. Many microscopic properties of inorganic compounds such as the arrangement of atoms, distances between atoms, surface composition, bonding, symmetry of the crystal structure are all directly related to the properties of light, sound, electricity and magnetism. At present, in the research of rare earth elements, a new field of rare earth physics has already emerged. Our nation's research in inorganic chemistry is too confined by the old traditional framework. The problem is that the infiltration of physics is too poor. There are two

reasons here: One is that workers in inorganic chemistry have a poor foundation in physics. Many comrades are confined by their old habits, and they do not pay attention to the utilization of new concepts and new methods. The second is that modern means of experimentation are too poor. Obviously, without the broad infiltration of physics, it is not possible for inorganic chemistry to realize major breakthroughs.

Fourth, the chemistry of inorganic solids and solid state physics in combination have become the two main pillars in developing new inorganic materials. The former studies the processes of chemical change in solids and control mechanisms, such as chemical changes in the processes of difussion, agglomeration and high temperature smelting, the mechanism of growth of crystals, corrosion and oxidation of solids, and electrochemical processes in solids. The latter studies the motion of atoms, electrons and lattices in solids, the effects of imperfections and impurities, etc. Because of the development in modern science and technology, the preparation of inorganic functional materials with such properties as sound, light, electricity, magnetism, heat, and force seems more and more important. During the past several decades, the synthesis of a large number of new inorganic materials has pushed development in the chemistry of solids forward. The chemistry of solids has already become an active field of research of chemistry and materials science. As early as 1965, foreign nations published special works on the chemistry of solids. In the study of new inorganic materials, our nation still mainly relies on "prescriptions," "cooking up dishes," and technological research at present. There is a lot of blindness, and very little profound theoretical research in the chemistry of solids is being done.

III. We Should Have a Uniformly Planned, Rationally Distributed Research System That Covers a Complete Range of Classifications and a Matching Depth

The research subject of inorganic chemistry includes all elements in the periodic table. Some chemists believe that our present research is centered on only a few elements while research in some important elements has not been carried out for a long period. Many comrades have proposed that research in the elements does not have to be classified as single elements. They can be considered in subgroups or types. The forces in the research of our nation's abundant elements can be strengthened and there can be more people. Appropriate forces should also be deployed in studying some ordinary elements and some "unspecific moves" can be made. We can develop rare earth chemistry through the study of rare earth elements. We can develop the chemistry of transition elements such as vanadium, titanium, tungsten, molybdenum through the study of useful elements of the Panzhihua and Jinchuan Mines. We can develop the chemistry of alkaline metals, alkaline earth metals and boron chemistry and the chemistry of concentrated solutions through the study of salt lakes. We can develop the chemistry of precious metals through the study of platinum family elements. The mineral deposits of this family of elements are scattered in our nation but their reserves may not be small. We should understand their patterns and find substitutes through research. This will simultaneously benefit comprehensive retrieval of low grade precious metallic ore in our nation. Therefore, the study of platinum family elements must be strengthened. We should develop inorganic chemistry related

to environmental pollution through the study of heavy metallic elements and other elements related to environmental pollution, etc.

In addition, division of labor must also be clearly established in the study of halide chemistry, the rare and scattered elements gallium, indium, thallium, selenium, tellurium, and actinium series elements. It is generally believed that inert gases do not participate in chemical reactions and they are an "infertile wasteland" of the periodic table undeveloped by man. In 1960, a British chemist synthesized the first xenon hexafluoroplatinate crystal. After that, the chemistry of inert gases developed prosperously. More than 1,300 papers have been published, and the chemistry of inert gases once became a fashionable research field. Up to now, nobody in our nation has studied it, and we should establish ourselves in that field.

We must also conscientiously arrange research efforts in the internationally active research fields of bio-inorganic chemistry, organo-metallic chemistry, and the chemistry of inorganic solids.

IV. We Must Pay Attention to the Mutual Connection Among Basic Research, Developmental Research, Applied Research. We Must Appropriately Evaluate the Achievements in Basic Research and Actively Solve the Problem of Corresponding Conditions

The development and study of our nation's abundant elements are strongly comprehensive. They require mutual coordination among basic research, applied research and developmental research, and they require mutual interdisciplinary and interregional cooperation. They cannot "all be studied" by one department alone. Therefore, how to appropriately evaluate the function of each unit and the various types of research work is very important. Generally speaking, intermediate experiments and industrial experiments require more effort than laboratory experiments. On the other hand, we must also fully confirm pioneering research work conducted in the laboratories. Some achievements are preludes to large industrial applications. We must respect their labor and give such achievements appropriate evaluation. It is like a person who eats three pieces of bread. We cannot credit only the third piece of bread for making the person full. In the past, some units failed to mention anything about the function of basic research after achieving success in intermediate experiments and industrial experiments. As a result, the relationship between units was affected, cooperation was affected, and the enthusiasm of engaging in necessary long-term and in-depth basic research was dampened.

It is generally believed abroad that the ratio of basic research, applied research and developmental research should be 1:2:6. Although this refers to the ratio among several types of research in a nation, this ratio shows that scientific research needs to form a system of matched depth. Mutually appropriate amount of manpower and materials must be invested at different levels before science and technology can be quickly converted into practical productive forces so that scientific research can develop its best economic effect in the national economy. Every year, the state allocates a relatively large amount of funds for the development and study of our nation's several

paragenetic mines. The funds have basically been used in applied and developmental research. But there are no funds for basic research. Especially higher educational institutions that are relatively strong in teaching and scientific research in inorganic chemistry. But because the channels were not open and there were no sources of funds, this force did not have "an opportunity to show its strength," and it was anxious but unable to do anything. This problem has been talked about for many years but it has not yet been solved well. "A skillful housewife cannot cook without rice." With a lack of necessary conditions, some basic research in our nation's abundant elements would be "idle theorizing."

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CSO: 4008/162

APPLIED SCIENCES

SPECIAL TEAMS SCOUT DESERT FOR DEBRIS FOLLOWING ROCKET LAUNCHINGS

OW051313 Beijing Domestic Service in Mandarin 2340 GMT 4 Jun 82

[Summary] "An observation and search contingent has been operating at a base of the national defense scientific and technological commission in the depths of the Gobi Desert in China's northwest. For 20 years, the cadres and fighters of the contingent have been charged with the task of searching for the wreckage of the nose cones of various types of rockets."

When a launch vehicle leaves the ground, people always cheer for the success of its launch. However, this is only the beginning of a test. Only when the wreckage of the nose cone of the rocket is recovered by the search party in the desert area can we determine if the test is successful or not.

"Before the launch, the nose cone of a carrier rocket is bulky and heavy. It has to be lifted for installation by a special crane. However, after atmospheric friction, the debris which falls to the ground is only about the size of a hat, and some fragments are about the size of a finger." It is indeed very difficult to recover the debris from an area with a circumference of several hundred kilometers in the desert.

The cadres and fighters of the contingent have to reach the area near the point of impact several hours before the launching and sometimes have to spend a whole night in order to discover the point of impact of a launch vehicle. They have to overcome all kinds of difficulties in recovering the wreckage of a rocket, including digging in drifting sand. Led by (Zhang Xin), head of the contingent, they have been fulfilling all their difficult tasks.

Once, they went to a spot in the desert called the "death sector," a place of dunes and swamps. It was said that two members of a search team were lost in the area several years ago and that no one has ever escaped from the "death sector." However, the cadres and fighters of the contingent were not afraid of the place and conducted a careful search.

"On another occasion, they were searching for fragments which must not come into contact with a human body. Those taking part in the search activities had to wear protective clothing and helmets. They could not drink, eat, have a bowel movement or urinate. The contingent selected six strong comrades to work in the search operation for a whole day in this manner. They successfully accomplished their task."

Now many banners of honor and certificates of merit are hung on the wall of the office of the contingent.

CSO: 4008/192

APPLIED SCIENCES

COMPUTER APPLICATIONS IN CHINA DESCRIBED

Beijing BEIJING RIBAO in Chinese 30 Nov 81 p 2

[Article by Fan Youde [5400 2589 1795]: "Computer Applications in China Begin To Show Benefits"]

[Text] This reporter has learned from the recent experience exchange meeting of provincial, municipal and prefecture computer centers held in Jinan by the State Scientific and Technological Commission that many computer centers in China have applied computers to various branches of the national economy, including industry, agriculture and communication, based on the actual needs in the local area and have obtained initial economic benefits.

When applied to industry and communication, computers played an important role in improving production efficiency. The success rate of determining the location for mine shaft drilling by the Brigade No 309 of Bureau No 3 of the Second Ministry of Machine Building has been only 30 percent in the past. Each shaft drilled in the wrong location costs 200,000 yuan and the location determination has been a big problem at the brigade. The Hunan Provincial Computer Center helped them determine the location with statistical methods, such as trend analysis, and increased their success rate to 80 percent. The Shandong Provincial Computer Center helped the provincial food department make the wheat, corn and yam allocation and distribution plan for the July 1980 to June 1981 crop year. When compared to the man-made plan, the computer plan saved 210,000 yuan just from railroad transportation in Shandong Province alone.

In some areas the computer center also collaborated with agricultural and meteorological departments and applied computers to agricultural production and obtained encouraging results. The computer center at Ningxia Autonomous Region conducted a general survey of the meteorological data in Lingwu County and, based on the survey results, the county weather station made the forecast that from 1978 to 1980 the precipitation would be low and the temperature would be high in the month of April and recommended that the agricultural departments make arrangements for early watering of the spring wheat. The entire county took proper measures accordingly and, as a result, except for the production drop in 1979 due to yellow leaf disease of wheat, the county had bumper crops of wheat in 1978 and 1980, with increases of 3.6 million jin and 4.9 million jin respectively. The Zhejiang Meteorological Bureau and Longquan County Weather Station conducted a 4-year multiple-point

observation of the major meteorological factors and the rice growth in the mountainous region of Longquan County and accumulated more than 20 million pieces of data. Correlation analysis and grouping analysis done on the computer identified the relationship between the local mountain area weather change and the large regional weather, clarified the growth and adaptability of different varieties of rice at different altitudes and determined that the maximum altitude for planting rice is 600 meters (previous practice was to plant rice only up to 200 meters). County agriculture departments accepted this suggestion and planted different varieties of rice at different altitudes and thereby increased the farm land in the county by 800,000 mu and increased the crop production by 500 million jin per year.

9698
CSO: 4008/126

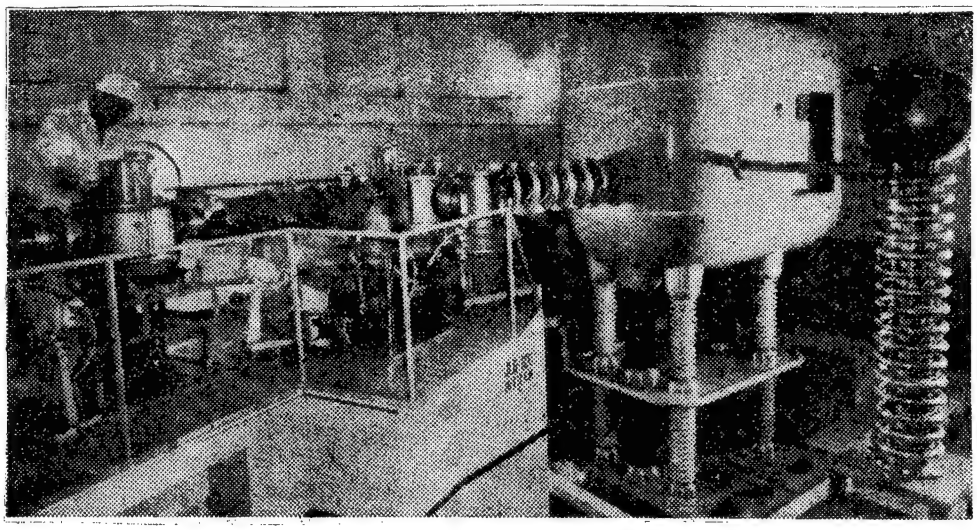
CHINA'S FIRST HIGH ENERGY PLASMA INJECTOR DESCRIBED

Shijiazhuang HEBEI RIBAO in Chinese 14 Feb 82 p 1

[Article: "China's First 600,000-volt High Energy Plasma Injector Put Into Use"]

[Text] The Hebei Institute of Semiconductors has developed China's first 600,000-volt high energy plasma injector and put it into use.

This high energy plasma injector meets advanced international standards. It is a sophisticated piece of equipment used in semiconductor research and production. It can inject light ions, such as oxygen, hydrogen, nitrogen and phosphor, and rare-earth and metallic elements into silicon, germanium and especially semiconductor compounds, such as gallium arsenide and indium phosphate, to make high quality components of a new type of structure or material. It plays an important role in the improvement of component performance and yield and in the simplification of manufacture procedure and structure format. It can be used in the research of microwave components, photoelectric components, optical integrated circuit, semiconductor compound components and large-scale integrated circuits. Hence, the successful development of the 600,000-volt high energy plasma injector has done more than fill a void in the area of semiconductor development in China.



China's first 600,000-volt high energy plasma injector developed by the Hebei Institute of Semiconductors. (Photo by Liu Zhiwei [0491 1807 0251])

The technical staff of the Hebei Institute of Semiconductors adhered to the principle that science and technology should serve economic construction and aimed at the real needs in China. After 5 years of tedious hard work, they have overcome one hurdle after another and finally succeeded in developing this piece of equipment.

9698
CSO: 4008/126

OPINIONS CONCERNING MIDDLE-AGED SCIENCE AND TECHNOLOGY PERSONNEL VOICED

Beijing GUANGMING RIBAO in Chinese 27 Feb 82 p 2

[Article by Hu Hanlin [5170 3352 7207] of the Dalian Institute of Chemical Physics, Chinese Academy of Sciences: "Bring Out the Positive Factors in Middle-aged Science and Technology Personnel"]

[Text] To ease the urgency of the personnel problem, an important task before us is to bring out the positive factors in middle-aged science and technology personnel.

There are two reasons for doing so. First, most of the science and technology personnel are now middle-aged. According to statistical figures of our institute, the average age of senior personnel is 56.8 years, intermediate level science and technology personnel have an average age of 46, and the average age of junior personnel is 39. The junior level and intermediate level people are mostly middle-aged, with an average of 42.5, and their number accounts for 81.7 percent of the total number of science and technology personnel. Second, the assume most of today's important assignments. They play the role of inheriting from their predecessors and opening up a new future. Among the intermediate level personnel in our institute, the number of research group leaders is 75.3 percent of all group leaders, and the number of laboratory directors and deputy directors is 40 percent of the total. Therefore, bringing out the positive factors in middle-aged science and technology personnel is an important and urgent task for developing personnel potential. This fact has now been realized by many comrades, but work is lagging behind in many areas and some comrades even think that middle-aged personnel are the most vocal and "hard to deal with." The middle-aged personnel are in fact the backbone of the technical force, but they are not receiving the proper attention and care. This situation has caused considerable inconvenience to middle-aged personnel and sometimes this inconvenience is not understood by others. This is the reason for their dissatisfaction which gives people the impression that they are hard to deal with.

In order to develop the positive factors in middle-aged science and technology personnel, we believe we can take the following approaches:

1. The use of talent should be flexible. Middle-aged science and technology personnel should be especially liberally employed according to the principle of merit. We should particularly avoid picking on their irrelevant weaknesses. It is inevitable that middle-aged people have some small flaws and we should never blame them for them. Sometimes a person who has no shortcomings on any account is precisely the kind of person who achieves nothing. The task of science and technology has its own special feature, namely, personnel evaluation must be related to results. Evaluating personnel without looking at the achievements is detrimental to research development. Selecting talents from science and technology personnel is different from selecting party and political workers and cannot be conducted using the same standards and methods of selecting leadership cadres.

2. We should pay more attention to middle-aged science and technology personnel politically and absorb the qualified ones into the party organization actively but prudently. Middle-aged science and technology personnel have all received long-term cultivation by the party and experienced the service tests of various political movements. Most of them have deep sentimental feeling toward the party and many of them have repeatedly applied for party membership. Some of them have been repeatedly turned down and yet they are still hopeful. Therefore, in attracting them into the party, we should set aside biases, such as family origin, social connection, rank and level of job, and the length and continuity of work experience. Whenever possible, we should avoid waiting to settle their party membership question until after they get old.

3. Pay attention to the cultivation of middle-aged science and technology personnel. In addition to regular professional improvement, cultivation is largely letting them assume responsible jobs. Professional improvement is always temporary and less extensive, whereas assuming a responsible job is long-term and extensive. It is particularly important in the improvement of standards of middle-aged science and technology personnel. Everybody has the intention of moving upward and as long as there is proper guidance, the initiative and sense of responsibility can be strengthened. This initiative and sense of responsibility constitutes a major driving force for building up trained personnel. To turn this into reality, we should be on the one hand against "confronting" middle-aged personnel and on the other hand supportive of academic democracy. This democracy is to free science and technology personnel from social bias and the suppression and restraint of "authority" while adhering to the four basic principles, and thereby insuring the development of "let a hundred schools of thought contend." Only then can we produce more and more trained personnel and achievements.

4. Difficulties in the livelihood of middle-aged science and technology personnel should be solved as high priority problems. After the downfall of the "gang of four," party policies regarding intellectuals have gradually been put on a solid basis and the living conditions of science and technology personnel have been improved. This naturally includes middle-aged personnel. Take salary, for example--all but four of the middle-aged science and technology personnel in our institute who graduated from colleges between the early 1960's and the "Cultural Revolution" have had pay raises of one to three levels and the average pay raise per person has been 13 yuan. But even so, their average salary is still only 67.76 yuan. The housing conditions of technical staff in our institute have been improved in the

past few years, with 103 families of intermediate level science and technology personnel having moved into new homes with two rooms. But today there are still 78 families of intermediate rank personnel living in single room houses, not to mention junior level personnel. With available resources, we should solve their difficulties as a high priority problem whenever possible. This is motivated by an overall interest consideration. Because middle-aged science and technology personnel are in the "golden age" of their scientific research, it is highly significant that their lives be made more comfortable so that they can concentrate on their work and produce useful results. This overall interest should be taken into consideration when policies regarding middle-aged science and technology personnel are formulated.

9698
CSO: 4008/126

BRIEFS

GEOLOGICAL MAPS BY REMOTE SENSING--Based on remote sensing and field survey data, Chen Yinxiang [7115 5593 4382], deputy director of the Remote Sensing Committee of the Chinese Geological Society, member of the National Geomorphological Mapping Committee, and chief engineer of the Remote Sensing Center of the Ministry of Geology, and his three assistants have recently compiled a total of 96 maps for the 5.8 million square kilometer region from Lanzhou and Haxat in the north to the Indian and Pakistan plains in the south, from the eastern section of the Pamirs in the west to Chengdu and Kunming in the east, including geomorphological maps of 800,000 square miles on a scale of 1:1 million, Quaternary geological maps, new tectonic movement diagrams, thermodynamic geological structure and mineral distribution maps. These are the first geological maps compiled for the Qinghai-Tibet plateau and its neighboring regions. [By Li Wei [2621 5588]] [Text] [Beijing GUANGMING RIBAO in Chinese 30 Nov 81 p 2] 9698

LOW TEMPERATURE LABORATORY--The joint establishment of a low temperature laboratory by the Institute of Physics and the Institute of Semiconductors of the Chinese Academy of Sciences has shed light on how to improve backward scientific research in China at a time of material and funding shortages. In order to develop condensed matter [ningjutai 0413 5112 1966] physics research, the Institute of Semiconductors planned to develop basic research of semiconductor optics, electricity and magnetism at low temperatures. This called for a low temperature laboratory, but the currently available facilities at the Institute of Semiconductors could not achieve the necessary low temperatures. The Institute of Physics, on the other hand, had shop facilities, equipment parts and a wealth of low temperature technological knowledge but did not have certain special equipment. After negotiations, the two institutes signed an agreement at the end of 1979 and decided to jointly establish a low temperature laboratory at the Institute of Physics and cooperate in the development of low temperature and strong magnetic field research needed badly by both institutes. The establishment of this laboratory has not only improved the utilization rate of equipment and instruments, but has also avoided repetitious imports and saved great amounts of capital for the state. In the past 2 years, these two institutes have obtained good results on joint research projects in semiconductor materials and laser components in the low temperature laboratory. [By He Chunfan [0149 2504 5672] [Excerpt] [Beijing BEIJING RIBAO in Chinese 26 Feb 82 p 2] 9698

DJM310 COMPUTER DEVELOPED--The Beijing Computer Plant No 1 has recently developed a sophisticated and versatile teaching machine--the DJM310 hybrid analog computer. The analog computer is a major class of computers. They are widely used in industrial automatic control and in the defense and research sectors. But the analog computers used for teaching in today's institutes of higher learning in China are mostly obsolete first generation machines--pure analog computers. The hybrid analog computer developed by the Beijing Computer Plant No 1 is a product between the second generation and the third generation. It is capable of high speed calculation, real-time and super real-time simulation of automation systems and can also be used for automatic optimization. It is an advanced teaching tool and can be applied to small-scale scientific research and automatic control. This hybrid analog computer has recently been approved in state appraisal and is officially under production. [By Zong Ming [1350 2494]] [Text] [Beijing BEIJING RIBAO in Chinese 21 Oct 81 p 2] 9698

CSO: 4008/126

TALK BY LU JIAXI OF THE CHINESE ACADEMY OF SCIENCES

Shanghai WEN HUI BAO in Chinese 21 May 82 p 1

[Article: "Expression of the Policy of the Party Central Committee on Relying on Scientists to Manage the Academy of Sciences -- Formation of New Leading Party Group in the Chinese Academy of Sciences -- Party Group Secretary Lu Jiaxi Presents Some Views on Work Arrangements for the Current Year"]

[Text] This reporter learned the following today: With the approval of the CCP Central Committee, the Chinese Academy of Sciences has formed a new leading Party group and Lu Jiaxi [4151 0857 6932] has been appointed as the Party group secretary. This Party group is the realization of the policy of the Party Central Committee to the effect that management of the Academy of Sciences should be in the hands of the scientists.

Lu Jiaxi is a famous structural chemist who is sixty-six years old this year. In May of last year, he was selected as the Director of the Chinese Academy of Sciences.

This Party group of the Chinese Academy of Sciences is composed of seven members. Hu Keshi [5170 0344 1395] and Yan Dongsheng [0917 2639 3932] are the vice-secretaries of the Party group. The previous Party group secretary Li Chang [2621 2490] is the adviser.

After the new Party group was established, Party group secretary Lu Jiaxi said the following at the cadre meeting: I am assuming my position at a time of transition in which work is under reorganization. For my part, this is a very difficult mission. I have a profound sense of the great importance of my task and I appreciate the great trust placed on me by the Party Central Committee and the expectations of my comrades. Now that the Party Central Committee has placed this burden on my shoulders, I shall bear it with all my strength and do my utmost to bear it well. He also said: The work of the Academy of Sciences must be arranged with the primary emphasis on scientific research. Under the leadership of the Party, we must unite scientific research work, professional management, administration and political ideology work under "a single cover."

In discussing the arrangement of work for this year, Lu Jiaxi emphasized the following points:

-- Positive, cautious execution of structural reform. In the first half of the year, the primary emphasis should be on readjustment and reform of Academy organs, while in the latter half of the year research will be done on structural reform of research institutes in the Beijing region. Reform of Academy organs should be centered on scientific research to achieve the objectives of organizational retrenchment, training of personnel and cadre, rapid handling of work, decrease in repetition and conveniencing primary levels.

-- Selection of outstanding cadres on the basis of requests provided by the Party Central Committee. Suitable arrangements should be made for old cadres to leave and retire. In order to decrease errors in cadre selection work as much as possible, we should hold to taking the mass line, democratic evaluation and testing the popular will; we should adhere to "appointing people on their merits"; and we should adhere to making decisions by collective discussion. We must select qualified persons and choose and recommend the able from the broad masses of cadres. If people are being used inappropriately, we will welcome everyone's criticism. At the same time, we must never forget the contributions that the old cadres made during the times of revolution. We set a high value on their self-consciously leaving and retiring and on their spirit of taking the interests of the whole into account in order to meet the requirements of furthering the revolutionary enterprise. We should make the most suitable arrangements possible for them with respect to political treatment and remuneration for their livelihood.

-- Organize for cooperation in tackling key problems. One of the most important objectives of science and technology is to serve the national economy and building of national defence. We must bring the superiority of the many scientific departments and many arms of the Academy of Sciences into full play, we must organize our selves effectively, we must adopt a positive attitude and we must get a grasp of a number of important matters in order to make the proper contributions to establishing the four modernizations for our nation. At the same time, we must work closely and cooperate with the departments concerned in tackling key problems and in solving the overall major key technical problems in establishing the nation. Basic research cannot be weakened but must advance progressively on a firm basis. Applied research must be vigorously strengthened.

-- A comparatively great advance in Party spirit must be made in the Academy of Sciences. We must ask Party members, and first and foremost Party cadres, to intensify their study, to improve their work style and to establish a good style of study and a scientific morality. At present, we should put our emphasis on the problems of organizational reform and of cooperating in tackling key problems, on establishing healthy tendencies and on criticizing erroneous ideological behavior and improper style.

In recent years, there has been a series of great reforms in the leadership system of the Chinese Academy of Sciences in such aspects as relying on scientists to manage the Academy of Sciences and realizing a democratic election system and a tenure system. The formation of the new leading Party group represents a great step forward on this foundation.

10019
CSO: 4008/179

SHANGHAI INSTITUTE OF BIOCHEMISTRY OF THE ACADEMY OF SCIENCES ELECTS NEW RESEARCH DIRECTORS

Shanghai WEN HUI BAO in Chinese 21 May 82 p 1

[Article by Zhu Kehua (2612 0344 5478) and Xu Shujian (1776 2885 0256): "Democratic Reelection of Directors at Shanghai Institute of Biochemistry -- A Group of Middle-Aged Scientific Research Personnel with Both Ability and Political Integrity Fill Leadership Posts"]

[Text] Most recently, the Institute of Biochemistry of the Chinese Academy of Sciences democratically elected the directors and vice-directors of all eight research laboratories of the institute. A group of middle-aged scientific research personnel in the prime of life with both ability and political integrity has filled the leadership posts.

This is not the first time that there has been a democratic election of laboratory directors at this institute. Institute Chief Wang Yinglai [3769 2019 4202] sincerely requested that he not serve concurrently as a laboratory director but that a younger comrade be allowed to manage the group. Twelve of the 22 newly elected vice-directors and chiefs of associated factories were elected for the first time, resulting in a lowering of the average age of the professional leadership cadres of the research laboratories and factories from 57 years to 51 years.

Before the elections, Professor Wang Debao [3769 1795 1405] was the sole director of the Second Research Laboratory, which had just participated in the first world conference on the artificial synthesis of ribonucleic acid. He was very busy, having to leave the country to give lectures and having to leave to attend meetings. He also had to take part in the concrete organization and direction of research. During the period when he was director of the Academy, he also had to concern himself with some professional work. This time, the two newly elected middle-aged assistant research personnel have assumed the duties of vice-directors of the laboratory. When Wang Debao left the country most recently, these two vice-directors actively undertook the leadership work so that scientific research work proceeded normally. After comrade Lin Qishei [2651 0366 6142] was appointed as director of three laboratories, with the assistance of the research laboratory Party branch, he established a laboratory work conference system and strengthened leadership of scientific research work. At the same time, he also gave attention to developing regular academic exchanges, assisting scientific research personnel in expanding their horizons and promoting scientific research work.

10019
CSO: 4008/179

AUTHOR: QIU Deman [6726 1795 3341]

ORG: Luoyang Glass Plant

TITLE: "Trend of Development of Glass for Automobiles in China and in Foreign Countries"

SOURCE: Changchun QICHE JISHU [AUTOMOBILE TECHNOLOGY] in Chinese No 5, 25 May 82 pp 2-5

ABSTRACT: Following a general introduction of the history of automobile glass and the types of glass used in automobiles, this paper reports the origin and development of automobile glass in China. The first toughening furnace in China was constructed in 1958 and since then toughened glass has been produced by several glass works for use as windshields of automobiles and tractors and curved windshields began to be manufactured in 1960. The productivity is still low and there is no uniformity in sizes and specifications, however. Some automobiles in China still have common heat bent windshields which are easily broken into fragments. For the purpose of standardizing automobile production, the new regulation of the Ministry of Transportation requires toughened glass for all automobiles but the supply remains deficient. Four types of safety glass, the flat toughened glass, the curved toughened glass, the flat laminated glass, and the curved laminated glass, are now being produced in China. They will soon be used to replace the ordinary heat-bent glass for all automobiles in China.

6168
CSO: 4009/339

AUTHOR: ZHANG Jingmin [1728 2417 3046]

ORG: Tianjin Electrical Drive Institute

TITLE: "A Microcomputer Control System for Blast Furnace Burden System"

SOURCE: Shenyang XINXI YU KONGZHI [INFORMATION AND CONTROL] in Chinese No 3, 1982 pp 21-27

TEXT OF ENGLISH ABSTRACT: This paper describes hardware, software and interfacing circuits of a microcomputer control system used for weighing error correction, and coke moisture measurement and compensation in blast furnace burden preparation.

Methods of improving reliability and interference suppressing capability have also been suggested.

AUTHOR: GAO Dianhua [7559 3013 5478]
WU Zhensheng [0702 2182 3932]

ORG: None

TITLE: "Application of ROM's in Digital Systems"

SOURCE: Shenyang XINXI YU KONGZHI [INFORMATION AND CONTROL] in Chinese No 3, 1982 pp 36-40

TEXT OF ENGLISH ABSTRACT: LSI ROM's have found wide use in digital systems. This paper reviews their applications in static logical and timing circuitry with the emphasis on their applications in automatic control systems and programmable telemetric systems.

9717
CSO: 4009/358

AUTHOR: LIN Shouyuan [2651 1343 6678]

ORG: Nanjing Research Institute of Electronic Technology

TITLE: "The Matching of Signal to a Network and Its Applications"

SOURCE: Beijing DIANZIXUE TONGXUN [JOURNAL OF ELECTRONICS] in Chinese No 3, 1982 pp 137-140

TEXT OF ENGLISH ABSTRACT: A new concept about the matching of a signal to a network is proposed. For an n-port microwave network, if all incident waves are proportional to the conjugates of corresponding scattering parameters of network S^*_{ki} (i = 1, ...,n), then the ratio of the power of scattering waves at the k-th port to the sum of the power of all incident waves reaches the maximum. Using this concept, we find some problems may be simplified when microwave networks are studied. To illustrate application of the concept, a description of an ultrabroad-band line transformer and an antenna array is given in this paper.

AUTHOR: LI Zicai [2621 1311 2088]
WANG Tianze [3769 1131 3419]
YAN Zhanggen [0917 2874 2704]
LIU Qiusheng [0491 4428 3932]

ORG: LI of the Shanghai Institute of Computing Techniques; WANG of the Beijing Electron Tube Factory; YAN of Qinghua University; LIU of Factory 4401

TITLE: "A Calculation of the Temperature Field of the Vaporization Cooling Electrode Used in High Power Electron Device"

SOURCE: Beijing DIANZIXUE TONGXUN [JOURNAL OF ELECTRONICS] in Chinese No 3, 1982 pp 192-197

TEXT OF ENGLISH ABSTRACT: The heat dissipation of anodes or collectors is one of the essential problems in the design of high power electron devices. In the past 20 years highly efficient vaporization cooling structure has been developed, but its design is still done by means of simulation or empirically. In this paper, a mathematical model for the vaporization cooling electrode and its solution are provided. The nonlinear and multi-valued properties of this mathematical physical equation are discussed. As an example, a numerical solution of the inner temperature field in a typical vaporization cooling electrode and an anode of a high power electron tube is given with a digital computer. Based on these results the design of vaporization cooling electrode and estimation of its heat dissipation capability are possible.

9717
CSO: 4009/333

AUTHOR: None

ORG: Information Office, Hangzhou Magnetic Recording Equipment Plant

TITLE: "Successful Manufacture of tye Y14A Double-sided Magnetic Disk Storage Device Test Instrument"

SOURCE: Beijing DIANZI KEXUE JISHU [ELECTRONIC SCIENCE AND TECHNOLOGY] in Chinese No 6, 10 Jun 82 p 48

ABSTRACT: The Y14A doubled-sided magnetic disk storage device test instrument, successfully manufactured by Hangzhou Magnetic Recording Equipment Plant, has been certified. This instrument is made in the shape of an attache case for convenient carrying, with a 72-line rectangular pegboard. It is designed for testing, adjusting, and repairing the ZPC-201 made in China and the ISOT 1370 made in Bulgaria. The major functions of the instrument include: (1) Manual search; (2) Automatic adding "1", subtracting "1" search; (3) Between "2 addresses" search; (4) Write-in protection; (5) Write-in 8-place random code; etc.

AUTHOR: None

ORG: Shanghai Bureau of Instruments and Meters

TITLE: "Three New Product Designs Finalized at Shanghai Radio Plant No 21"

SOURCE: Beijing DIANZI KEXUE JISHU [ELECTRONIC SCIENCE AND TECHNOLOGY] in Chinsse No 6, 10 Jun 82 P 48

ABSTRACT: The Shanghai Radio Plant No 21 is experimenting with the 3 new products of SR53 dual track double scan oscillograph, XJ17 general purpose oscillograph, and SG1 2-line high sensitivity oscillograph. Designs of all three items have been finalized. The SR53 has a bandwidth of DC - 30MHz and such functions as totally automatic trigger synchronization, automatic focusing, etc. It is light weight, being made partially with integrated circuits. The XJ17 is a new product designed to replace the SBT-5 synchronous oscillograph produced in the 50's. The major technical indices are the same as the SBT-5 and it is 1/6 in volume and 1/6 in weight, and consumes 6/7 less power ; the price will be 13 percent lower. The SG1 will have a maximum sensitivity of 10 μV/cm, the highest of all domestic oscillographs. Its major technical indices are close or equal to similar products made in foreign countries.

6248
CSO: 4009/340

AUTHOR: LI Guangzong [2621 0342 1350]
YU Jiayu [0151 1367 6877]

ORG: Both of the Research Division, Chengdu Exploration and Design Institute of Hydroelectric Power, Ministry of Water Conservancy and Electric Power

TITLE: "Behavior Analysis of the Lined Top-arch of Underground Hydro-powerhouse"

SOURCE: Nanjing YANTU GONGCHENG XUEBAO [CHINESE JOURNAL OF GEOTECHNICAL ENGINEERING] in Chinese No 2, 1982 pp 86-96

TEXT OF ENGLISH ABSTRACT: This paper presents and analyzes the long-term prototype observational data of some large underground hydro-powerhouses in China. The analysis shows that in both the distribution and the magnitude of stresses there exists a great difference between the value measured in prototype and the value designed by Protodyakonov's theory. All the reinforcement bar stresses measured in lined top-arch represent some time effect, i.e., these stresses increase steadily and slowly with the elapsed time. A visco-elastic model of K-H in series is used by the authors to analyze the rock pressure acting on a lined top-arch. In addition, some opinions for improving the design and construction of lined top-arch are suggested.

AUTHOR: LI Xiesheng [2621 0588 3932]

ORG: Chengdu Exploration and Design Institute of Hydroelectric Power, Ministry of Water Conservancy and Electric Power

TITLE: "Treatment of the Engineering Geologic Problems in the Underground Hydroelectric Power Plant of the Fisherman's Creek I"

SOURCE: Nanjing YANTU GONGCHENG XUEBAO [CHINESE JOURNAL OF GEOTECHNICAL ENGINEERING] in Chinese No 2, 1982 pp 107-118

TEXT OF ENGLISH ABSTRACT: The geological conditions of this underground hydroelectric power plant are very complex. The high angle faults, low angle faults and fractures in the same directions have developed under the influence of areal geological structures. The stability and perfection of the rock pillar between the main machine hall and the tailwater surge chamber have been spoiled by longitudinal and transversal fractures which intersected each other and dissected the rock pillar into more than 10 rock blocks. Simultaneously, some rather unstable rock masses were formed in some parts of the upstream and downstream sidewalls of the main machine hall. In addition, in consequence of the insufficiency of geological data and rock test results, the choice of the axis of the main machine hall and the layout of underground structures are not quite ideal. The density of rock chambers is very big, and the intersections of the chambers with lateral galleries totaled 19, thus enhancing the difficulty of construction of the underground power plant.

[Continuation of YANTU GONGCHENG XUEBAO No 2, 1982 pp 107-118]

Therefore, some suitable engineering structural measurements were adopted at the principal positions, such as the use of deep rock anchor piles, hollow anchor rock chambers, lateral buttress and propped beams; rectification of local layout; the adoption of a more reasonable construction schedule, and a series of constructional safety measures, such as capping, locking, anchoring, thrusting, bracing, hooping, etc. From prototype observations and the results of finite element analysis of the stress and deformation calculation of the surrounding rock, it is evident that these measures are effective and ensure the completion and safe operation of the underground power plant. Further prototype observations and investigations are still underway.

9717
CSO: 4009/357

AUTHOR: ZHANG Liming [1728 0448 2494]
LU Zukang [7120 4372 1660]
BEI Guohua [6296 0948 5478]

ORG: All of Zhejiang University

TITLE: "Laser High-speed Holography"

SOURCE: Hangzhou ZHEJIANG DAXUE XUEBAO [JOURNAL OF ZHEJIANG UNIVERSITY] in Chinese No 2, 1982 pp 115-128

TEXT OF ENGLISH ABSTRACT: A novel apparatus of laser high-speed holography is described, which mainly consists of a single-mode operating ruby laser and a light beam deflector. The laser is used as a coherent light source to produce sequential pulses. The light beam deflector is made of ZF-6/36°YLN. With this apparatus we have successfully taken the double-exposure dynamic holograms at a frequency up to 50 KHz, therefore, each picture has four to eight patterns. In the article, we discuss some fundamental questions, such as the steady operation conditions of the laser, the thermo-distortion of acoustic optical detectors and the selection of schemes for recording multiple holograms, etc. Finally, some experimental results are shown.

AUTHOR: JIN Tingzan [6855 1694 6363]

ORG: Zhejiang University

TITLE: "Design of Interactive Function in Computer Display"

SOURCE: Hangzhou ZHEJIANG DAXUE XUEBAO [JOURNAL OF ZHEJIANG UNIVERSITY] in Chinese No 2, 1982 pp 129-140

TEXT OF ENGLISH ABSTRACT: In the basic software of interactive computer display two fundamental problems must be considered. First is the graphic processing itself, such as graphic structure, storage, transformation and clipping. The author has expounded it in "Graphical Generation, Transformation and Clip in Computer Display" (JOURNAL OF ZHEJIANG UNIVERSITY, May 1980 and September 1980). The other is the interactive function design. Its feature is that the user can design interactive functions he requires, namely "light button" and "key function." In this paper, the design method on this topic with the author's practice is briefly introduced.

9717
CSO: 4009/356

AUTHOR: LUO Rutie [4382 1172 6993]

ORG: Department of Chemistry

TITLE: "A Computer Method for Generating Three-dimensional Kellogg Diagrams and Its Application to Thermodynamics of Roasting of Nickel Sulfide Ores"

SOURCE: Changsha ZHONGNAN KUANGYE XUEYUAN XUEBAO [JOURNAL OF CENTRAL-SOUTH INSTITUTE OF MINING AND METALLURGY] in Chinese No 2, 1982 pp 1-8

TEXT OF ENGLISH ABSTRACT: A computer method for constructing three-dimensional Kellogg diagrams is developed. By using a proper mathematic model, i.e., the equilibrium vector, predominance volume of each species is determined in such a way that the feasible set of a system of inequalities is arrived at in operation research. This makes the method simpler and more available. The use of extended BASIC language makes the procedure flexible. From the facts above, this method is especially suitable to the thermodynamic analysis of complicated more-variable systems. For example, the roasting of nickel sulfide ores is examined by generating the three-dimensional Kellogg diagrams for the four metal-sulfur-oxygen systems of nickel, copper, cobalt and iron, and by studying the position of predominance volumes of these systems in a bar-shaped region called Roaster Gas Composition Confined Bar and the effect of ferrite formation on roasting. The result is visual and consistent with industrial practices. Applications may be found in hydrometallurgy and in other fields.

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TITLE: "On the Key Factors of Design and Implementation of Language System for Computer Algebra"

SOURCE: Changsha ZHONGNAN KUANGYE XUEYUAN XUEBAO [JOURNAL OF CENTRAL-SOUTH INSTITUTE OF MINING AND METALLURGY] in Chinese No 2, 1982 pp 31-36

TEXT OF ENGLISH ABSTRACT: In this paper, first the design destination of language systems for computer algebra is determined. Second, based on the destination, the key factors of design and implementation of language systems for computer algebra are discussed according to the points of view of the design of system function and implementation. The problems to be solved are posed, and then the approach for solving them is given. Here the differences between the language system for computer algebra and that for numerical computing are emphasized.

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CSO: 4009/359

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ORG: All of Nanjing Institute of Technology

TITLE: "Nucleation and Early Stage Growth of Polycrystalline Silicon Deposition"

SOURCE: Nanjing NANJING GONGXUEYUAN XUEBAO [JOURNAL OF NANJING INSTITUTE OF TECHNOLOGY] in Chinese No 2, 1982 pp 91-104

TEXT OF ENGLISH ABSTRACT: The process of nucleation and structure of polycrystalline silicon film deposited on various substrates at 1050°C in a silane-hydrogen system are investigated. It has been found that both the nucleation behavior and structural features of the layer deposited in the early stage depend on the nature of substrates. In comparison with that on substrates of silicon oxide, the deposition on silicon nitride layer which covers the oxide surface results in earlier nucleation, smaller size and higher density of nucleus islands and finer grains. Reactions of silicon oxide with hydrogen and silicon deposited on it play an important role in the nucleation and growth of polycrystalline silicon on oxide substrates, and produce results different from those on the inert nitride substrates. The phase change in the condensed nuclei is also discussed.

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TITLE: "Fringe Effect During EPI/Polysilicon Codeposition and a Model of Two-Dimensional Diffusion in the Stagnant Layer"

SOURCE: Nanjing NANJING GONGXUEYUAN XUEBAO [JOURNAL OF NANJING INSTITUTE OF TECHNOLOGY] in Chinese No 2, 1982 pp 105-114

TEXT OF ENGLISH ABSTRACT: Experiments were carried out in which monocrystalline and polycrystalline silicon were simultaneously deposited on Si substrates selectively covered with SiO_2 or Si_3N_4 film. The fringe effect of abnormal nucleation on a narrow area of SiO_2 near the SiO_2/Si boundary is observed in a wide range of experimental conditions for SiO_2/Si substrates, but it does not take place on Si_3N_4/Si substrates. In this paper the fringe effect is explained by a horizontal diffusional flow, and a semiquantitative estimation is made by means of a two-dimensional diffusion model in the stagnant layer.

9717
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TITLE: "A New Computer Method for Fault Location on HV Transmission Lines"

SOURCE: Chongqing CHONGQING DAXUE XUEBAO [JOURNAL OF CHONGQING UNIVERSITY] in Chinese No 2, 1982 pp 1-18

TEXT OF ENGLISH ABSTRACT: This paper proposes a new computer method/impedance measuring method which is modified by the phase of fault current components. Under two-source line conditions, the new method can completely eliminate errors which usually exist in general impedance or reactance measuring methods due to the load currents and fault resistances, and also can determine the distance from the measuring terminal to the fault point with a high order of accuracy by using only current and voltage information at the measuring terminal of the transmission line.

The new method can also develop into a new algorithm of computer distance protection with superior properties to avoid the influences of load currents and fault resistance.

The high degree of accuracy of the new method has been verified by results which were obtained from tests using the CK-710 mini-control computer and the Apple II

[Continuation of CHONGQING DAXUE XUEBAO No 2, 1982 pp 1-18]

microcomputer to simulate different types of faults with various load currents, fault resistances and distances of fault points. The tests have been performed on the models of two HV power transmission lines: one is 220 KV, 243 KM long and the other is 130 KV, 47.3 KM long.

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TITLE: "On the Effect of Time Lag Upon the Economical Operation of Cascade Hydroelectric Power Stations"

SOURCE: Chongqing CHONGQING DAXUE XUEBAO [JOURNAL OF CHONGQING UNIVERSITY] in Chinese No 2, 1982 pp 91-102

TEXT OF ENGLISH ABSTRACT: In this paper we discretize the state parameter--flow of cascade hydroelectric power stations--into the step function of time variable, and use constrained nonlinear programming to establish a mathematical model of economical operation which is universally applicable for general cascade hydroelectric power stations, and then we discuss the primary factors which affect the value of the time lag. According to each case of different values of the time lag, we have derived the formulas for calculating the gradient of augmented objective functions and other important formulas which will be used in SUMT for optimization. Furthermore, we derive the functional relation between the time lag and the state of operation of cascade hydroelectric power stations. We have researched the situations in which the time lag will cause the mutual relation between hydroelectric power stations to change. Finally, we reveal the law that the time lag will affect the economical operation of cascade hydroelectric power stations.

9717
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TITLE: "Investigation of Surface Grain Refinement of Superalloy Castings"

SOURCE: Beijing JINSHU XUEBAO [ACTA METALLURGICA SINICA] in Chinese No 3, 1982 pp 255-263

TEXT OF ENGLISH ABSTRACT: The mechanism of the surface grain refinement for superalloy castings has been investigated by examination of some recent allied approaches and by observations on the investment molds of various effectiveness using X-ray diffraction, microscopy and EPMA. It was identified that the grain refinement of the castings is dependent upon the decomposition of cobalt aluminate and the active alloying elements contained in the alloy. After the alloy was cast, the isolated particles of high temperature type cobalt were found on the surfaces of the investment mold and the castings, as well as the products of the mixture of cobalt aluminate together with different active elements heated under a vacuum. Both the vacuum DTA of cobalt aluminate mixed with Al powder and the thermodynamical estimation of the reaction may confirm that the formation of Co particles did not accompany an endothermic peak as was formerly suspected, but, in fact,

[Continuation of JINSHU XUEBAO No 3, 1982 pp 255-263]

a small exothermic effect was observed. It seems that the surface grain refinement of the castings is mainly due to the nucleation of the cobalt particles produced during casting. Thus, a rationalized process proposed has already been put into industrial practice with remarkable results.

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TITLE: "A New High Strength Mg-Zn-Y-Zr Sheet Alloy"

SOURCE: Beijing JINSHU XUEBAO [ACTA METALLURGICA SINICA] in Chinese No 3, 1982 pp 309-310

TEXT OF ENGLISH ABSTRACT: A new high strength Mg sheet alloy, Mg-(3.0-3.8)percent Zn-(0.6-1.0) percent Y-(0.4-0.7) percent Zr, has been developed. The final heat treatment condition is the T_8 condition, namely, 515-520°C solution treated 1 hour, water quenched +15 percent cold work + 200°C 24 hours. Its room temperature tensile properties are shown as: σ_b = 33.5 - 34.0 or 29.0 - 30.0 kgf/mm^2; $\sigma_{0.2}$ = 30.0 - 30.5 or 19.5 - 20 kgf/mm^2; δ = 12-14 or 13.5 - 22.0 percent in longitudinal or transverse direction respectively. In addition, its tensile properties below 250°C are superior to those of both HM21XA-T_8 and AZ31B-H_{24}.

9717
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SOURCE: Beijing JILIANG JISHU [MEASUREMENT TECHNIQUE] in Chinese No 3, 18 May 82 p 63

ABSTRACT: With the assistance of Sichuan Provincial Research Institute of Metrological Tests and Experimentation and Chongqing Municipal Research Institute of Metrological Technology, the Peiling Prefecture Bureau of Metrology, Sichuan Province has succeeded in making the SJ-1 digital timepiece, which has been certified in Nov 81 by the Scientific Research Result Certification Conference, organized and called by the Sichuan Provincial Bureau of Metrology. With the photoelectric transducer, the digital timing instrument weighs 5.5 kg. Its stability is $\pm 1 \times 10^{-5}$ and the accuracy is $\pm 5 \times 10^{-5}$. Major technical specifications of the instrument are reported.

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TITLE: "Successful Manufacture of the YB Type Extensometer Inspection Instrument"

SOURCE: Beijing JILIANG JISHU [MEASUREMENT TECHNIQUE] in Chinese No 3, 18 May 82 p 64

ABSTRACT: In 1980, the National Bureau of Metrology assigned the task of studying on the making of an instrument to check and grade extensometers, an important instrument commonly used in testing the dynamic property of materials, to the Sichuan Provincial Zigong Municipal Bureau of Metrology. With the cooperation of Chongqing University, The 4th Region Stress Measurement Station of the Ministry of Machines No 5, and the Chongqing Special Steel Plant Research Institute, the Zigong Municipal Bureau of Metrology has completed the assignment after 2 years of hard work. The prototype has been through a large quantity of tests and repeated industrial experimentations before it was sent to production and research units for test application to prove it to be of good quality. Toward the end of 1981, a conference certified it. The successful manufacture of this instrument fills a blank in China and is definitely a contribution to the 4-modernization construction.

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TITLE: "A Study of Superconducting in C15 $(Hf_{0.5-x}Ta_xZr_{0.5})V_2H_y$ System"

SOURCE: Beijing DIWEN WULI [ACTA PHYSICA TEMPERATURAE HUMILIS SINICA] in Chinese No 2, 1982 pp 93-102

TEXT OF ENGLISH ABSTRACT: A study of superconducting of C15 $(Hf_{0.5-x}Ta_xZr_{0.5})V_2H_y$ system reveals that both the relationship between T_c and y and the mechanism of the effect of hydrogen on T_c in this system are different from those in the Pd-H system. The results of thermal neutron inelastic scattering show that acoustic phonons are important for the variation of T_c. An evaluation of the distribution of hydrogen atoms in small and large concentrations in different interstices has been made on the basis of the theory of Jacob and Miedema. It seems that superconducting T_c rises when hydrogen atoms occupy mostly the 2Zr-2V interstices. A possible explanation of this effect has been proposed.

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TITLE: "Optimum Design of Superconducting Magnets with High Homogeneity--Sixth-order Volume Minimized Coils"

SOURCE: Beijing DIWEN WULI [ACTA PHYSICA TEMPERATURAE HUMILIS SINICA] in Chinese No 2, 1982 pp 161-168

TEXT OF ENGLISH ABSTRACT: There is the possibility of reducing the cost of superconducting materials in the magnet if full use is made of the current carrying potentials of the middle and outer parts of the winding in the design of superconducting magnets with high homogeneity. It is proposed in this paper that the magnet consisting of two coaxial sixth-order coils with different current density will effect a considerable reduction in the cost of superconducting materials in the magnet if the ratio of the contribution to the central field of the inner and outer coils is properly selected. It is shown that in case of optimum design the cost of superconducting materials decreases by 40 percent when $R = C_2/C_1 = 1$, where C_2 and C_1 are the costs of unit volume of the outer and inner superconducting winding respectively; by 62 percent when $R = 1/2$; and by 66 percent when $R = 1/3$.

9717
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TITLE: "On the Future of Dongfanghong-4 Internal Combustion Locomotive"

SOURCE: Dalian NEIRAN JICHE [DIESEL LOCOMOTIVE] in Chinese No 5, 15 May 82 pp16-18, 26

ABSTRACT: From the 1st of May to the end of 81, the Dongfanghong-4 locomotives, No 0004, 0003, and 0002, produced by Ziyang Plant, had accumulated 27,418 km on the Zunyi to Guiyang Line. When this diesel engine was tested in Aug 81, it was confirmed that it can operate on lines of a grade limit of 20 percent and on less fuel than comparable Dongfeng-4 locomotives on the same lines. On its maiden trip, the governor on the 0002 broke down; 10 days later the nozzle of the antechamber broke off. After repairs had taken half a month, it operated for 20 thousand miles before cracks were discovered on 8 pistons. This time it took 9 months before the locomotive was back on the line but soon after it left Fengtai, the governor broke down again. In the No 4, 80 issue of this journal, seeking to be fair toward the Dongfanghong-4, the paper stated that in foreign countries, a locomotive usually takes 3-4 years before all its aspects are perfected; sometimes, even 8-10 years. The ND_4 diesel of France experienced many problems during its first 120 thousand km operation.

[continuation of NEIRAN JICHE No 5, 1982 pp 16-18, 26]

If such had been the case with a new product in China, perhaps some would suggest "shoot and kill them." The authors present arguments in the paper saying that the Dongfeng-4 took 7 years to complete and it was in reality an imitation product; therefore, a domestic design locomotive such as Dongfanghong-4 should certainly be given the opportunity and time it needs to improve its quality. The authors believe in spite of the problems and some antagonistic criticisms, the locomotive still should have a viable future, i.e. it should not be scrapped.

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CSO: 4009/338

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